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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/716,785	11/19/2003	Wu-Song Huang	FIS920030377US1	6138
32074 7590 02/05/2007 INTERNATIONAL BUSINESS MACHINES CORPORATION DEPT. 18G BLDG. 300-482 2070 ROUTE 52 HOPEWELL JUNCTION, NY 12533			EXAMINER LEE, SIN J	
			ART UNIT 1752	PAPER NUMBER
SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
3 MONTHS		02/05/2007	PAPER	

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 10/716,785	Applicant(s) HUANG ET AL.	
	Examiner Sin J. Lee	Art Unit 1752	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 January 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,5,7-16,19 and 21-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,5,7-16,19 and 21-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>1/17/2007</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. In view of the amendment of January 17, 2007, previous claim objections on claims 12, 13, 26 and 26 are hereby withdrawn.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1, 2, 5, 7-16, 19, 21-27 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sooriyakumaran et al (US 2002/0081520 A1) in view of Asakawa et al (5,863,699) and Bucchignano et al (6,037,097).

In his Example 3, Sooriyakumaran teaches partial protection of poly(2-hydroxy-3,3,3-trifluoropropylsilsesquioxane) with acid-cleavable trimethylsilyl group.

Sooriyakumaran also teaches using a photoacid generator as the second component of his resist composition (see [0056]). Sooriyakumaran does not teach present cyclic ketal acid-labile moiety.

Asakawa et al teaches the equivalence of the trimethylsilyl group (which is taught in Sooriyakumaran) and 1-methoxycyclohexyl group as acid-decomposable groups (see col.12, line 36 and 41). Therefore, in view of Asakawa's teaching of equivalency, it would have been obvious to one skilled in the art to use 1-methoxycyclohexyl group in partially protecting poly(2-hydroxy-3,3,3-trifluoropropylsilsesquioxane) in Sooriyakumaran's Example 3. *Furthermore*, Bucchignano teaches (col.2, lines 21-29, lines 35-53 and col.4, lines 37-50) that by using a cyclic aliphatic ketal substituent such as a methoxycyclohexanyl group as an acid labile protecting group for an aqueous base

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soluble copolymer, one can obtain a chemically amplified resist that provides improved resist coating shelf life and with little or no vacuum effects on use and that prevents air-borne contaminants from adversely affecting the chemical nature of the aqueous base soluble copolymer. Bucchignano also teaches (col.4, lines 51-58) that hydrogen of the cycloaliphatic portions of the ketal substituent can be substituted with hydrophobic groups such as $-\text{CF}_3$, $-\text{CHF}_2$, $-\text{CH}_2\text{F}$, $-\text{CCl}_3$, $-\text{CHCl}_2$, $-\text{CH}_2\text{Cl}$, and $-\text{Si}(\text{CH}_3)_3$ in order to obtain additional etch resistance. In view of Asakawa, which shows that the trimethylsilyl group and methoxycyclohexyl group were art-recognized equivalent acid-decomposable groups, and further in view of Bucchignano's teaching that methoxycyclohexanyl group provides improved resist coating shelf life and little or no vacuum effects on use, it would have been obvious to one of ordinary skill in the art to use the methoxycyclohexanyl group (or methoxycyclohexanyl group substituted with CF_3 , $-\text{CHF}_2$, $-\text{CH}_2\text{F}$, $-\text{CCl}_3$, $-\text{CHCl}_2$, $-\text{CH}_2\text{Cl}$, or $-\text{Si}(\text{CH}_3)_3$) as Sooriyakumaran's acid-cleavable group in his Example 3 *in order to obtain a chemically amplified resist that provides improved resist coating shelf life and with little or no vacuum effects on use and that prevents air-borne contaminants from adversely affecting the chemical nature of the aqueous base soluble copolymer*. Therefore, Sooriyakumaran in view of Asakawa and Bucchignano would render obvious present inventions of claims 1, 2, 5, and 7-10 (i.e., those references teach present fluoroalcohol moiety (present pendant solubility promoting moiety) protected with present cyclic ketal acid-labile moiety): **because present specification (pg.13, lines 19-32) also lists** ***"methoxycyclohexanyl" group as one of preferred examples for cyclic ketal***

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protecting groups that satisfy the first formula of claim 1, it follows that the methoxycyclohexanyl group, used as Sooriyakumaran's acid-cleavable group would inherently have a low activation energy less than about 20 kcal/mol for acid-catalyzed cleaving, and the same acid-cleavable group would inherently be cleavable at room temperature as presently recited.

Also, the poly(2-hydroxy-3,3,3-trifluoropropylsilsesquioxane) which is partially protected with methoxycyclohexanyl group as discussed above comprises present combination of monomeric units (II) and (III) in claims 12 and 25; *in the formula (III)*, X would be a methylene group, R^3 would be a H atom, R^4 would be $-CF_3$ (a fluorinated alkyl group), q would be 0, and R^6 would be $-OH$ (a solubility promoting group). In the formula (II), X would be a methylene group, R^3 would be a H atom, R^4 would be $-CF_3$ (a fluorinated alkyl group), q would be 0, and R^5 would be methoxycyclohexanyl oxy group (present solubility inhibiting cyclic ketal group). Also, such polymer comprises present combination of monomeric units (II) and (V) in claims 13 and 26; *in the formula (V)*, X would be a methylene group, one R^3 would be a H atom, another R^3 would be $-CF_3$ (a halogenated alkyl group), q would be 0, and R^6 would be $-OH$ (a solubility promoting group). Therefore, Sooriyakumaran in view of Asakawa and Bucchignano would render obvious present inventions of claims 12, 13, 25, and 26.

With respect to present claim 11, Sooriyakumaran teaches ([0055]) that his copolymer generally has an average Mw in the range of 1,000 to 5,000. Therefore, Sooriyakumaran in view of Asakawa and Bucchignano would render obvious present invention of claim 11.

Sooriyakumaran teaches ([0075]) a process for generating a resist image on a substrate which comprises the steps of: (a) coating a substrate with a film comprising his resist composition; (b) imagewise exposing the film to radiation; and (c) developing the image. Sooriyakumaran teaches ([0080]) that the pattern from the resist structure may then be transferred to the material of the underlying substrate by etching. Sooriyakumaran also teaches a post-exposure baking step (see [109]). Therefore, Sooriyakumaran in view of Asakawa and Bucchignano would render obvious present inventions of claims 14-16, 19, 21-24 and 30.

With respect to present claim 27, Sooriyakumaran teaches that a bilayer substrate may be employed in which his resist composition forms an upper resist layer on top of a bilayer substrate comprised of a base layer and underlayer that lies between the upper resist layer and the base layer. Thus, Sooriyakumaran in view of Asakawa and Bucchignano would render obvious present invention of claim 27.

4. Claims 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sooriyakumaran et al (US 2002/0081520 A1) in view of Asakawa et al (5,863,699) and Bucchignano et al (6,037,097) as applied to claim 27 above, and further in view of Khojasteh et al (US 2002/0058204 A1).

Sooriyakumaran in view of Asakawa and Bucchignano is discussed above in Paragraph 3. As discussed above, Sooriyakumaran teaches that a bilayer substrate may be employed in which his resist composition forms an upper resist layer on top of a bilayer substrate comprised of a base layer and underlayer that lies between the upper resist layer and the base layer. Sooriyakumaran does not teach present underlayer

composition of claim 28. Khojasteh teaches ([0009]-[0021]) an underlayer composition comprising (a) a polymer containing (i) cyclic ether moieties, (ii) saturated polycyclic moieties, and (iii) aromatic moieties, and (b) an acid generator, or an underlayer composition comprising (a) a polymer containing (i) saturated polycyclic moieties, and (ii) aromatic moieties, (b) an acid generator, and (c) a crosslinker. Khojasteh teaches that use of such an underlayer composition provide underlayers having outstanding optical, mechanical and etch selectivity properties ([0008]). In view of Khojasteh's teaching, it would have been obvious to one of ordinary skill in the art to use Khojasteh's underlayer composition for Sooriyakumaran's underlayer in order to obtain underlayer having outstanding optical, mechanical and etch selectivity properties as taught by Khojasteh. Khojasteh also teaches ([0058]) that the polymer of the underlayer composition preferably contains a fluorine components such as pentafluoroaryl group and trifluoromethyl group. Therefore, Sooriyakumaran in view of Asakawa and Bucchignano and further in view of Khojasteh would render obvious present inventions of claims 28 and 29.

Response to Arguments

5. Applicants first argue that cyclic ketals would not be considered equivalent to TMS as an acid-decomposable group by one skilled in the art by referring to the reference, Ota et al, which shows that acetal protecting group such as THP has a higher deprotection reaction rate than TMS and then referring to present specification which states that ketal protecting groups typically have higher reaction rates in comparison to acetal systems up to a thousand times faster. However, applicants' such arguments are

not persuasive because the reference Asakawa et al'699 *still teaches* the equivalence of the trimethylsilyl group and 1-methoxycyclohexyl group *and* applicants have not provided on the record any showing of unexpected superior results of present invention (as also suggested by the Examiner in the telephonic interview conducted on October 4, 2006) to *prove* that those two groups are not equivalent as suggested by Asakawa. That is, applicants have not shown a comparison of Sooriyakumaran's polymer of his Example 3 protected with 1-methoxycyclohexyl group (which teaches present polymer) v. Sooriyakumaran's polymer in his Example 3 (which is protected with trimethylsilyl group) to prove *unexpectedly* superior results of present invention. Attorney arguments cannot take the place of evidence. See MPEP 716.019(c).

Applicants also argue that synthesizing cyclic ketal protecting groups on larger solubility promoting moieties in the structure of present invention or Sooriyakumaran is not predictable since the structure of Bucchignano is different than the structure of Sooriyakumaran and will not necessarily results in the desired resist composition. In doing so, applicants refer to the publication by Schmalijohann et al and Sinta. Applicants argue that in Schmalijohann, more powerful neutral catalysts (i.e., more powerful than p-toluene sulfonic acid) like ATPB was necessary in the protection reaction whereas in Sinta, p-toluene sulfonic acid, which can result in significant reaction exotherms and can form undesired side products, is the stronger catalyst than oxalic acid or malonic acid. However, *at best*, applicants such arguments seem to suggest that when protecting a polymer with acid-labile groups, one just needs to choose different kinds of catalysts (e.g., choose a catalyst that gives higher conversion

rate or a catalyst that does not yield undesired side products) depending on the structure of the polymer. The Examiner is not sure how such argument shows that one skilled in the art would not have had reasonable expectation of success in obtaining Sooriyakumaran's polymer protected with cyclic ketal groups. Again, in order to show that it would not be obvious to one skilled in the art to protect Sooriyakumaran's polymer with methoxycyclohexanyl group as argued by the Examiner, applicants need to prove that the comparison of Sooriyakumaran's polymer of his Example 3 protected with 1-methoxycyclohexyl group (which teaches present polymer) v. Sooriyakumaran's polymer in his Example 3 (which is protected with trimethylsilyl group) shows unexpectedly superior results of present invention.

For the reasons stated above, present 103(a) rejections still stand.

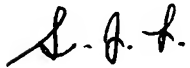
6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sin J. Lee whose telephone number is 571-272-1333. The examiner can normally be reached on Monday-Friday from 9:00 am EST to 5:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cynthia Kelly, can be reached on 571-272-1526. The fax phone number for the organization where this application or proceeding is assigned is **571-273-8300**.

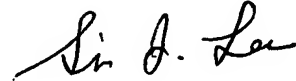
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only.

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For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



S. Lee
February 1, 2007



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PRIMARY EXAMINER